Title: Hyperspectral Data Analysis for Estimation of Foliar Biochemical Content along the Oregon Transect

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Discipline: Land

The NASA Oregon Transect Ecosystem Research (OTTER) project (described elsewhere in these proceedings by D. Peterson) completed a data acquisition phase during the period March-October, 1990. Data were acquired with several airborne imaging spectrometers. Included were the Airborne Visible and Infrared Imaging Spectrometer (AVIRIS) aboard the ER-2, the Advanced Solidstate Array Spectrometer (ASAS) aboard the C-130, and the Fluorescence Line Imager (FLI) and Compact Airborne Spectrographic Imager (CASI), both aboard light aircraft. In addition, Spectron™ visible and near-infrared data were acquired in transects across study areas from a low-altitude ultralight craft. Sunphotometer data were taken approximately coincident with each overflight for atmospheric correction of the aircraft data.

A primary goal of the OTTER project is the remote estimation of canopy nitrogen and lignin content. Past research with the Airborne Imaging Spectrometer (AIS) has shown sensitivity to foliar nitrogen and lignin absorption in the near-infrared region between 1200-2400 nanometers. During the data analysis phase, AVIRIS data will be used to build upon the AIS findings, and to extend the study into the 400-1200 nanometer region. AVIRIS spectra will be statistically related to laboratory assays of chemical content from foliage samples at each site. Estimation equations will be developed by use of both waveband selection (stepwise multilinear regression) and data compression (partial least squares regression) techniques. The sensitivity of AVIRIS data to foliar nitrogen and lignin will be

evaluated in light of three main variables: stage of the growing season, environmental conditions (temperature, rainfall, elevation), and artifically-induced fertility gradients. Biochemical indicators in the visible region will be compared with data from the ASAS, CASI, and FLI. Ultimately, remotely-derived measures of biochemical content will be input to the FOREST-BGC forest ecosystem model.

Another OTTER objective is the remote estimation of chlorophyll pigmentation in coniferous ecosystems. The primary instruments for this effort are the high spectral resolution (~2 nm.) CASI and FLI. Chlorophyll-induced red edge position and depth of the chlorophyll absorption well will be examined. The feasibility of characterizing these parameters with the coarser resolution AVIRIS (~10 nm.) and ASAS (~15 nm.) instruments will be addressed by comparison with FLI and CASI. Laboratory chemical assays of chlorophyll A/B concentration will be available for verification.

Spectra of fresh foliage samples were acquired in the laboratory with Spectron™ and LICOR™ portable spectroradiometers during the June, August, and October field campaigns. These data will be useful in establishing the nominal spectral response of foliage at each site in the absence of confounding atmospheric and background effects associated with the aircraft data.